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Contribution from the Bureau of Public Roads, THOS. H. MacDONALD, Chief
in cooperation with the Office of Farm Management and
Farm Economics, H. C. TAYLOR, Chief

Washington, D. C.

February 25, 1921

CORN-BELT FARMERS' EXPERIENCE
WITH MOTOR TRUCKS

A STUDY OF 831 REPORTS FROM FARMERS
WHO OWN MOTOR TRUCKS

By

H. R. TOLLEY, Agricultural Engineer, and
L. M. CHURCH, Assistant in Farm Accounting

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SUMMARY.

This bulletin summarizes the experience with motor trucks of 831 grain and live-stock farmers in the corn belt who have motor trucks for use on their own farms.

The average size of their farms is 347 acres. This is considerably greater than the average size of all farms in the corn belt.

Only 14 per cent of these farms are less than 5 miles from market and 20 per cent of them are 15 miles or more. The average distance from market is 8 miles, while the average distance from market of all farms in the corn belt is probably not over 4 miles.

A little over one-fourth of these men have changed their markets, for at least a part of their produce, since purchasing trucks. For those who have changed market, the average distance to the old market was 7 miles and to the new market is 18 miles.

Fifty-seven per cent of these men have not reduced the number of their work stock since purchasing trucks. Twenty-five per cent have disposed of one or two head, and 18 per cent of more than two head. The average reduction for all farms is 1.2 head. It is apparent, therefore, that to a large extent the motor truck supplements rather than supplants the horse on the farm.

The rated capacity of these trucks varies from one-half to 2 tons. Seventy-one per cent of them are rated at 1 ton, and only 9 per cent of them at less than 1 ton.

Experience with trucks has caused 57 per cent of these men to decide that the 1-ton size is best for their conditions; 25 per cent that the 1½-ton size is best; and 12 per cent that the 2-ton size is best. Practically one man in four has decided that a truck larger than the one he now owns is better suited to his conditions.

Ninety-one per cent believe that their trucks will prove to be profitable investments.

In the opinions of these men the principal advantage of a motor truck is in saving time, and the principal disadvantage is "poor roads."

As compared with horses and wagons, the trucks save about two-thirds of the time required for hauling to and from these farms.

On the average there are over eight weeks during the year when the roads are in such condition on account of mud, snow, ice, and frost that these trucks can not be used. The roads on which nearly 95 per cent of them usually travel are all or part dirt.

The condition of the roads prevented the use of the trucks with pneumatic tires a little less than seven weeks during the year covered by the reports, and of those with solid tires a little over nine weeks.

Twenty-four per cent of the trucks are equipped with pneumatic tires, 27 per cent with solid tires, and 49 per cent with pneumatics in front and solids in rear. However, experience has convinced 58 per cent that pneumatics are best for their conditions, 35 per cent that solids are best, and 7 per cent that pneumatics in front and solids in rear are best.

These men have return loads for their trucks about one-third of the time.

A majority of these men still use their horses for some hauling on the road.

On more than half of the farms all the hauling in the fields and around the buildings is still done with horses and wagons.

About 40 per cent of these men did some custom hauling with their trucks during the year covered by the reports. The average amount received by those who did such work was \$132.

Their owners estimate that on the average these trucks travel 2,777 miles and are used on 112 days per year.

The average estimated life of these trucks is $6\frac{1}{2}$ years, and on this basis depreciation is usually the largest single item of expense in connection with their operation.

The average cost of operation, including depreciation, interest on investment, repairs, registration and license fees, fuel, oil, and tires, is 15.2 cents per mile for the one-half and three-fourths ton trucks, 15.2 cents for the 1-ton, 21.3 cents for the $1\frac{1}{4}$ and $1\frac{1}{2}$ -ton, and 25.8 cents for the 2-ton.

The average cost of hauling crops, including the value of the driver's time at 50 cents per hour, is 24.0 cents per ton-mile with the one-half and three-fourths ton trucks, 24.1 cents with the 1-ton, 23.3 cents with the $1\frac{1}{4}$ -ton and $1\frac{1}{2}$ -ton, and 21.5 cents with the 2-ton trucks.

Nearly 85 per cent of these trucks had not been out of commission when needed for a single day during the year covered by the reports, and 80 per cent of the owners stated that they had not lost any appreciable time on account of motor or tire trouble, breakage, or other mechanical difficulties when using their trucks. About one truck in 15 was out of commission more than five days, however, and one owner in 40 reported a loss of more than 5 per cent of the time when using his truck.

Half of these men own tractors as well as motor trucks. Most of the tractors are owned on the larger farms, however. Only 33 per cent of the men whose farms contain 160 crop acres or less own tractors, while 65 per cent of those with over 320 crop acres own them. The number of work stock kept on the farms where both trucks and tractors are owned is only slightly less than the number kept on the farms of corresponding size where only trucks are owned.

Seventy-eight per cent of these farmers state that their trucks reduce the expense for hired help. On those farms where there is a reduction the operators estimate that it amounts to \$209 per year on the average.

METHOD OF STUDY.

In February and March of 1920 a questionnaire was sent to each of approximately 15,000 farmer truck-owners in Illinois, Indiana, Iowa, eastern Kansas, southern Minnesota, Missouri, eastern Nebraska, southeastern South Dakota, and southern Wisconsin. The questionnaire called for the type and size of farm, the use the farmer makes of his motor truck, the cost of operating it, his idea of its profitableness, the advantages and disadvantages of a truck for farm use, and other related information. In all about 15 per cent of the farmers replied to the questionnaire. However, only reports from grain and live-stock farmers, who raise corn as one of the principal crops, were included in the study.

All reports from men owning second-hand trucks or trucks made by the addition of truck units or attachments to passenger cars, those

from men who had owned their machines six months or less, and those from men who are using their trucks primarily for custom work or in connection with other business, and only incidentally for farm work were also excluded. Thus all of the 831 reports which form the basis of this bulletin are from men who are practicing the general grain and live-stock farming characteristic of the corn belt and who own trucks which were purchased new and which have been in use long enough to enable their owners to form an intelligent idea of their worth.

LOCATION AND SIZE OF FARMS.

The number of reports from the different States, the average size of the farms, and the average number of crop acres per farm are given in Table I. The average size of these farms where motor trucks are owned is considerably greater in every State than the average size of all farms. For instance, the reports of the 1910 census show that the average size of all farms in Illinois was only 129 acres, in Indiana 99 acres, in Iowa 156 acres, and in Missouri 125 acres. The number of acres planted to crops on the farms studied is also large, the average number of crop acres per farm being 248. Seventy-two per cent of the farms have over 160 crop acres and 21 per cent have more than 320 crop acres.

TABLE I.—*The number of reports from different States, average size of farm, and average number of crop acres per farm.*

State.	Number of reports.	Size of farm (acres).	Crop acres.	State.	Number of reports.	Size of farm (acres).	Crop acres.
Illinois.....	114	316	239	Southeastern South			
Indiana.....	52	267	214	Dakota.....	154	471	301
Iowa.....	216	285	230	Southern Wisconsin.....	17	245	160
Eastern Kansas.....	44	466	274				
Southern Minnesota.....	32	286	228	Total.....	831		
Missouri.....	86	381	260	Average.....		347	248
Eastern Nebraska.....	116	324	233				

All the reports included from the States of Kansas, Nebraska, South Dakota, Minnesota, and Wisconsin are from men operating farms in the sections where corn is one of the principal crops. Every one of the 831 reports is from a man who raises corn as one of his principal crops, and in most cases the raising and feeding of hogs is an important enterprise. Reports from farms where dairying is the principal enterprise are not included.

DISTANCE TO MARKET.

Probably the most striking point concerning these farms is their great distance from market as compared with other farms in the same section of the country. Only 14 per cent of these farms are less than

5 miles from market and 20 per cent are 15 miles or more. A part of these men who have long hauls have changed their markets since buying trucks (see p. 19), but the average distance of all farms to the markets used before the purchase of trucks is 8 miles. (See fig. 1.)

Eight hundred and fourteen men reported the distance from their farms to the towns where the materials hauled by truck are usually



FIG. 1.—The motor truck is most advantageous to the man who is far from market or shipping point.

marketed. The exact number of farms at different distances from market is as follows:

- 117, or 14 per cent, are less than 5 miles from market.
- 325, or 40 per cent, are from 5 to 9 miles from market.
- 213, or 26 per cent, are from 10 to 14 miles from market.
- 75, or 9 per cent, are from 15 to 19 miles from market.
- 84, or 11 per cent, are 20 miles and over from market.

Farm survey records of other farms in different areas of the corn belt indicate that a majority of all the farms in this section are less than 5 miles from market. The average distance from market of 2,213 corn-belt farms, as shown by records in the office of Farm Management and Farm Economics, is 3.9 miles, and the number at different distances is as follows:

- 1,535, or 69.3 per cent, are less than 5 miles from market.
- 642, or 29.1 per cent, are from 5 to 9 miles from market.
- 36, or 1.6 per cent, are 10 miles and over from market.

These 2,200 farms can not be considered as exactly representative of all corn-belt farms, but a comparison of their distances from mar-

ket with the distances from market of the farms on which trucks are owned show clearly that most of the men whose reports form the basis for this bulletin have exceptionally long hauls.

SIZE OF TRUCKS.

The motor trucks owned on these 831 farms vary from one-half ton to 2 tons in size. Only 10 are of the one-half-ton size, however, and in all of the tables following the one-half-ton and three-fourths-ton sizes are combined into one group. Similarly, there are three trucks rated at $1\frac{1}{4}$ tons, and they have been combined with those rated at $1\frac{1}{2}$ tons. None over 2 tons in size was reported. In general the larger trucks are used on the larger farms.

The number of the different sizes, the average size of the farms on which they are owned, and the average number of crop acres per farm are shown in Table II:

TABLE II.—*Number of trucks of different sizes and size of farms on which they are used.*

Size of truck.	Total number.	Average size of farm (total acres).	Average crop acres.
$\frac{1}{2}$ -ton and $\frac{3}{4}$ -ton....	74	333	229
1-ton.....	588	328	236
$1\frac{1}{4}$ -ton and $1\frac{1}{2}$ -ton..	109	407	294
2-ton.....	60	434	309
Total.....	831		
Average.....		347	248

AGE OF TRUCKS.

The length of time the 831 trucks had been in use at the time the reports were made is as follows:

- 394 had been in use 7 to 12 months.
- 375 had been in use 13 to 24 months.
- 55 had been in use 25 to 36 months.
- 7 had been in use 37 months or over.

ARE THESE TRUCKS PROFITABLE INVESTMENTS?

No attempt was made to determine to what extent the incomes of these men had been increased through the use of their trucks. However, 91 per cent of them stated that in their opinion their trucks will turn out to be profitable investments.

On the average these trucks travel 2,777 miles a year, and the cost of operation is between $16\frac{1}{2}$ cents and 17 cents per mile, making the total annual cost from \$460 to \$470. Each truck displaces 1.2

head of work stock. At present the average cost of keeping a horse a year in the corn belt is around \$200. The reduction in expense for this item, then, is in the neighborhood of \$240 per farm. For all farms the average amount of hired help saved by the trucks is \$163. On most farms these are the only two items of direct reduction in expense which can be credited to the truck, and on the average they amount to \$60 or \$70 less than the total cost of operating a truck.

To offset this added cost, custom hauling done with the trucks amounts to \$50 per year for all farms, leaving only something like \$10 or \$20 annual net expense, which must be more than balanced by the saving of time of the owner and members of the family, the ability to get crops and live stock to market in better condition or at better times, and other benefits which are not directly measurable in dollars and cents, if the average truck is to be a profitable investment.

So far as could be determined, the size of the truck, the length of time it had been in use, and the size of the farm have little to do with the owner's idea of its profitableness. Some of the men who do not consider their trucks profitable have found them unreliable, so that the repair bills have been excessive or the machines have been out of commission when needed. Of all the 831 trucks only 19 had been out of commission when needed more than 10 days during the year covered by the reports, and the owners of 8 of these 19 trucks consider that they are unprofitable.

Eight-ninths of these men whose trucks are not proving profitable have not found it possible to dispose of any of their horses. Part of them have also found that they do not have enough work for the truck to justify the investment in such an expensive piece of equipment. About one-quarter of them had driven their trucks less than 1,000 miles and used them on less than 30 days during the year.

THE BEST SIZE.

The fact that these men considered their motor trucks profitable investments does not mean, however, that they are all entirely satisfied with the particular machines which they own. It is very important that the truck should be of the proper size for the hauling which it is to do. Ordinarily both the first cost and the cost of operation of a small truck will be less than of a large one, but often the small truck will not carry as large loads as is desired, and more trips to haul a given amount of material will therefore be necessary than with a larger truck. A truck which is too large, however, would have to be operated with only a partial load a great part of the time, and the extra cost may more than offset the advantage of being able to carry larger loads on exceptional occasions. Each farmer was

asked to state what size he considered the best for his conditions, regardless of the size he now owns, and 804 men answered as follows:

- Of 70 who now own $\frac{1}{2}$ -ton and $\frac{3}{4}$ -ton trucks—
 - 2 consider that the best size is $\frac{1}{2}$ -ton.
 - 29 consider that the best size is $\frac{3}{4}$ -ton.
 - 28 consider that the best size is 1-ton.
 - 8 consider that the best size is $1\frac{1}{2}$ -ton.
 - 3 consider that the best size is 2-ton.
- Of 570 who now own 1-ton trucks—
 - 1 considers that the best size is $\frac{3}{4}$ -ton.
 - 423 consider that the best size is 1-ton.
 - 2 consider that the best size is $1\frac{1}{4}$ -ton.
 - 100 consider that the best size is $1\frac{1}{2}$ -ton.
 - 42 consider that the best size is 2-ton.
 - 2 consider that the best size is over 2-ton.
- Of 107 who now own $1\frac{1}{4}$ -ton and $1\frac{1}{2}$ -ton trucks—
 - 7 consider that the best size is 1-ton.
 - 2 consider that the best size is $1\frac{1}{4}$ -ton.
 - 85 consider that the best size is $1\frac{1}{2}$ -ton.
 - 11 consider that the best size is 2-ton.
 - 2 consider that the best size is over 2-ton.
- Of 57 who now own 2-ton trucks—
 - 3 consider that the best size is 1-ton.
 - 10 consider that the best size is $1\frac{1}{2}$ -ton.
 - 42 consider that the best size is 2-ton.
 - 2 consider that the best size is over 2-ton.
- In all—
 - 2 consider that the best size is $\frac{1}{2}$ -ton.
 - 30 consider that the best size is $\frac{3}{4}$ -ton.
 - 461 consider that the best size is 1-ton.
 - 4 consider that the best size is $1\frac{1}{4}$ -ton.
 - 203 consider that the best size is $1\frac{1}{2}$ -ton.
 - 98 consider that the best size is 2-ton.
 - 6 consider that the best size is over 2-ton.

Nearly 95 per cent of the total prefer either the 1-ton, $1\frac{1}{2}$ -ton, or 2-ton size, with the 1-ton size preferred by 57 per cent of the total. Some of these men have evidently purchased trucks which experience has proved to be too small for their needs. While 583, over 72 per cent, consider that the size they now own is best for their conditions, 200, approximately 25 per cent, prefer sizes larger than they now own, and only 21, less than 3 per cent, prefer sizes smaller than they own.

ADVANTAGES AND DISADVANTAGES.

There are many advantages in the ownership of a motor truck, but just how great these advantages are and which ones should be given the greatest weight are questions which the man who has not had experience with a motor truck can seldom answer. A summary of the answers of 712 of these truck owners to the question "What

is the principal advantage of a motor truck for farm use?" is given in Table III:

TABLE III.—*The principal advantage of a motor truck as given by 712 farmers.*

Principal advantage.	Number reporting.	Per cent of total.	Principal advantage.	Number reporting.	Per cent of total.
Time saved.....	635	89	Better market.....	4	1
Save horses.....	32	4	Other.....	18	3
Convenience.....	17	2			
Reduce expense.....	6	1	Total.....	712	

Nearly 90 per cent of the owners report that the saving of time is the principal advantage. There are other advantages, of course, but in the minds of these farmers this is the principal one. While only four of these men report that the principal advantage of the truck is that it enables them to go to a better market, more than a fourth of the total number are going to better markets now than before the purchase of their trucks. Going to a market which is farther from the farm is simply a matter of taking more time for marketing, and a considerable number of the men who say that saving of time is the principal advantage find that the truck saves them sufficient time to enable them to go to the better market. Reducing shrinkage when marketing live stock, which is often mentioned as one of the big advantages of a motor truck, is also largely a matter of reducing the time required for getting the stock from farm to market.

The fact that such a small number consider the saving of horses, the reducing of expense, and added convenience, as the principal advantages of the truck, indicates that the amount of time which the motor truck will save, which may incidentally result in reaching a better market or getting live stock and crops to market in better condition, is the item which should be given paramount importance when considering the purchase of a motor truck.

The disadvantages of a truck should be considered as well as the advantages, and these men were asked what they had found to be the principal disadvantage. A summary of 413 answers to this question is given in Table IV. Of the remaining 418 farmers 261 did not answer the question, and 157 stated that they knew of no disadvantages in owning a truck.

TABLE IV.—*The principal disadvantage of a motor truck as given by 413 farmers.*

Principal disadvantage.	Number reporting.	Per cent of total.	Principal disadvantage.	Number reporting.	Per cent of total.
Poor roads.....	299	73	Incompetent driver.....	5	1
Cost of operation.....	46	11	Other.....	14	3
First cost.....	33	8			
Soft ground.....	10	2	Total.....	413	
Mechanical trouble.....	6	2			

It is seen that 73 per cent consider that "poor roads" is the principal disadvantage. A large percentage of the reports stated that there is some time during the year when the roads are in such a condition that motor trucks can not be used. (See p. 17.) The men who live on unimproved roads, of course, have the greatest handicap in this respect, but even the best of roads may be impassable for a truck because of snow at certain times of the year in this section. After poor roads the cost of the truck, either the cost of operation or the first cost, is considered the greatest disadvantage. The fact that the truck can not be operated satisfactorily on soft ground is next in importance, and troubles due to incompetent drivers and mechanical defects complete the list of disadvantages mentioned by more than one or two farmers.

ROAD HAULING WITH TRUCKS.

All of the material hauled to and from these farms has been divided into five general classes—viz, crops, live stock, building material, fuel, and other material. An idea of the relative amounts of these different materials hauled by the trucks can be obtained from the fact that, during the year covered by the reports—

481 farmers reported hauling a total of 40,029 tons of crops.

339 farmers reported hauling a total of 6,629 tons of live stock.

166 farmers reported hauling a total of 7,111 tons of building material, including fencing.

120 farmers reported hauling a total of 1,642 tons of fuel.

132 farmers reported hauling a total of 7,704 tons of other material.

All crops are included, but a large percentage of the total is grain. Similarly hauling all kinds of live stock was reported, but hogs make a large percentage of the total. (See fig. 2.)

Each farmer reported the weight of the load which he ordinarily hauls, the length of haul, and the time required for the round trip with the truck. Similar information was given for hauling with horses and wagons before the purchase of trucks. The time required for the round trip includes the time required for loading and unloading the truck or wagon.

Table V shows a comparison of the size of load, length of haul, and time required for hauling crops with trucks of different sizes, and with wagons before the purchase of trucks. Table VI gives a like comparison for live stock, Table VII for building material, and Table VIII for fuel.

The hours per ton-mile in each case are obtained by dividing the hours per round trip by the product of the size of the load in tons and the length of haul in miles. For instance, in Table I, a $\frac{1}{2}$ -ton or $\frac{3}{4}$ -ton truck hauling a load of 2,652 pounds a distance of 8.0 miles ac-

compleishes 10.61 ton-miles of hauling. Since it takes 1.7 hours to make the round trip the time required per ton-mile is 0.16 hour.

A comparison of the hours per ton-mile required for hauling with truck with the hours per ton-mile for hauling with wagon gives the proportion of time saved by the truck. When hauling crops and building material the average size of load hauled with the $\frac{1}{2}$ -ton and $\frac{3}{4}$ -ton and the 1-ton trucks is smaller in each case than the average size of load hauled with wagon. The reverse is true for the larger-sized trucks. When hauling fuel the loads hauled with all except the 2-ton trucks are smaller than the loads with wagons. On account of this the proportion of time saved by the larger trucks is somewhat greater than that saved by the smaller ones.

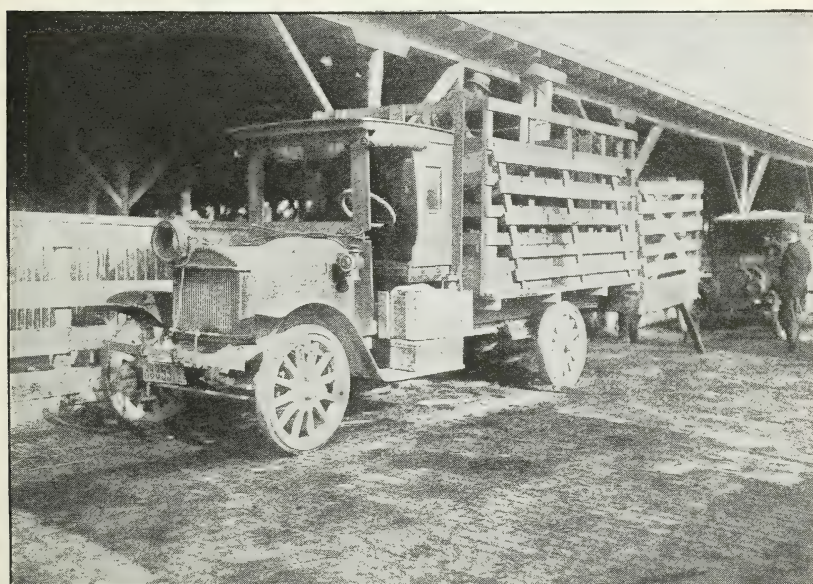


FIG. 2.—Unloading hogs at stockyards from farm-owned truck. Motor trucks enable many farmers to haul live stock direct to central markets which are too far away to be reached with horses and wagons.

TABLE V.—Comparison of time required to haul crops with trucks and with wagons before the purchase of trucks (481 reports).

Size of truck.	With truck.				With wagon.			
	Size of load (pounds).	Distance (miles— one way).	Hours per round trip.	Hours per ton-mile.	Size of load (pounds).	Distance (miles— one way).	Hours per round trip.	Hours per ton-mile.
$\frac{1}{2}$ -ton and $\frac{3}{4}$ -ton.....	2,652	8.0	1.7	0.16	2,892	7.1	5.4	0.53
1-ton.....	2,626	9.1	2.2	.18	2,937	8.8	6.4	.50
1 $\frac{1}{2}$ -ton and 1 $\frac{1}{2}$ -ton.....	3,490	8.9	2.0	.13	3,098	8.9	6.3	.46
2-ton.....	4,409	9.4	2.3	.11	3,143	8.6	6.2	.46

TABLE VI.—*Comparison of time required to haul live stock with trucks and with wagons before the purchase of trucks (339 reports).*

Size of truck.	With truck.				With wagon.			
	Size of load (pounds).	Distance (miles—one way.)	Hours per round trip.	Hours per ton-mile.	Size of load (pounds).	Distance (miles—one way.)	Hours per round trip.	Hours per ton-mile.
$\frac{1}{2}$ -ton and $\frac{3}{4}$ -ton.....	1,831	8.2	1.4	0.19	1,698	7.7	5.5	0.84
1-ton.....	2,023	12.1	2.7	.22	1,923	9.8	7.0	.74
$1\frac{1}{4}$ -ton and $1\frac{1}{2}$ -ton.....	2,512	11.6	2.4	.16	1,886	8.5	6.2	.77
2-ton.....	3,284	9.4	2.0	.13	1,947	8.5	6.0	.73

TABLE VII.—*Comparison of time required to haul building material with trucks and with wagons before the purchase of trucks (166 reports).*

Size of truck.	With truck.				With wagon.			
	Size of load (pounds).	Distance (miles—one way.)	Hours per round trip.	Hours per ton-mile.	Size of load (pounds).	Distance (miles—one way.)	Hours per round trip.	Hours per ton-mile.
$\frac{1}{2}$ -ton and $\frac{3}{4}$ -ton.....	2,475	6.3	1.6	0.20	2,850	7.0	5.1	0.51
1-ton.....	2,548	8.6	2.2	.20	3,049	8.1	6.1	.49
$1\frac{1}{4}$ -ton and $1\frac{1}{2}$ -ton.....	3,813	7.6	2.0	.14	3,310	7.2	5.4	.45
2-ton.....	4,227	8.3	2.2	.13	3,245	7.5	6.6	.54

TABLE VIII.—*Comparison of time required to haul fuel with trucks, and with wagons before the purchase of trucks (120 reports).*

Size of truck.	With truck.				With wagon.			
	Size of load (pounds).	Distance (miles—one way.)	Hours per round trip.	Hours per ton-mile.	Size of load (pounds).	Distance (miles—one way.)	Hours per round trip.	Hours per ton-mile.
$\frac{3}{4}$ -ton and 1-ton.....	2,533	7.4	1.8	0.19	2,808	7.9	6.3	0.57
1-ton.....	2,523	8.3	2.2	.21	2,815	7.8	6.1	.56
$1\frac{1}{4}$ -ton and $1\frac{1}{2}$ -ton.....	3,436	9.1	2.4	.15	3,464	8.3	6.5	.45
2-ton.....	4,917	9.2	2.2	.10	3,067	9.2	5.1	.36

TIME SAVED BY TRUCKS.

The length of time required to haul different distances with wagons and with trucks gives a more direct measure of the saving in time due to the use of a truck. Table IX shows the average time required to haul crops different distances with wagons as given by these men, and Table X the time required for hauling with motor trucks. The time required for hauling live stock and all other materials is practically the same as for hauling crops both with trucks and with wagons. For each distance it requires approximately one-third as long to make a round trip with a truck as it does with a wagon, and if the

same size loads are hauled with trucks as with wagons the time required per ton-mile will be practically one-third as much with truck as with wagon.

TABLE IX.—*Time required for hauling crops different distances with wagons.*

Distance hauled (miles).	Number of reports.	Hours per round trip.	
		Average.	Hours reported most frequently.
2 and 3....	31	2.5	2½ (10 reports).
4 and 5....	89	3.7	3 (8 reports).
6 and 7....	133	4.7	3 (19 reports).
8 and 9....	94	6.1	4 (26 reports).
10 and 11..	72	7.5	4 (31 reports).
12 and 13..	51	9.0	5 (33 reports).
14 and 15..	22	8.9	5 (26 reports).
16 and 17..	12	10.8	6 (19 reports).
18 and 19..	11	11.2	6 (17 reports).
			8 (22 reports).
			8 (9 reports).
			10 (13 reports).
			9 (6 reports).
			10 (7 reports).
			
			

TABLE X.—*Time required for hauling crops different distances with motor trucks.*

Distance hauled (miles).	Number of reports.	Hours per round trip.	
		Average.	Hours reported most frequently.
2 and 3....	32	1.0	1 (18 reports).
4 and 5....	89	1.2	1 (33 reports).
6 and 7....	142	1.6	1½ (20 reports).
8 and 9....	99	2.0	1½ (51 reports).
10 and 11..	82	2.4	2 (35 reports).
12 and 13..	50	2.9	1½ (14 reports).
14 and 15..	28	2.9	2 (42 reports).
16 and 17..	17	3.5	2 (26 reports).
18 and 19..	17	4.1	2½ (21 reports).
			2½ (13 reports).
			3 (14 reports).
			3 (13 reports).
			
			

RETURN LOADS.

The percentage of time which a truck is run without load has a direct bearing upon the cost per unit of hauling with it. If an owner can arrange to haul a load to market and then bring back a load of supplies to his farm on the same trip he can reduce the time required and expense by practically 50 per cent. The reports of these men show that they have return loads for their trucks about 34 per cent of the time. About 10 per cent, however, stated that they never have return loads. Apparently the size of the truck, the length of the time it has been in use, and the distance from the farm to market have little to do with the number of return loads for the truck.

ROAD HAULING FOR WHICH TRUCKS ARE NOT USED.

The majority of these men still use horses to supplement their trucks in hauling on the road. Of 510 men who reported concerning their use of horses for road hauling only 195, or 38 per cent, stated that they do all their hauling with trucks. The reasons given by 305 of the remaining 315 for using horses for hauling on the road are shown in Table XI. It is seen that nearly three-fourths of these men give "poor roads" as the reason for using horses; that is, it was necessary to do some hauling to and from the farm at some time during the year when the roads were in such condition that the truck could not be used. After poor roads the reason given most frequently is that the body with which the truck is equipped is unsuitable for carrying the material which is to be hauled.

TABLE XI.—*Reasons for using horses for hauling on the road.*

Reasons for using horses.	Number reporting.	Per cent of total.	Reasons for using horses.	Number reporting.	Per cent of total.
Poor roads.....	219	71	Truck too light.....	8	3
Truck body unsuitable.....	42	14	Keep horses busy.....	3	1
Truck busy.....	12	4	Other.....	21	7

It was not possible from the reports to determine the exact proportion of the road hauling which is still done by horses on these farms. However, on a large percentage of them horses are used only for hauling which it is necessary to do when the roads are in such condition that the trucks can not be used, and such hauling would ordinarily amount to only a small percentage of the total. The size of loads and distance hauled with horses are approximately the same as given in Tables V to VIII.

HAULING ON THE FARM WITH TRUCKS.

Of 352 men who reported on the use of their trucks for hauling on the farm (i. e., in the fields and around the buildings), 199, or 57 per cent, stated that they do not use their trucks at all for such work. The reasons for not using the truck for hauling on the farm was not given in every case, but a large number stated that their trucks were not suitable for such work. The smaller trucks in many cases will not carry as large loads as it is desired to haul; often the truck can not obtain traction in the fields, and sometimes the body with which it is equipped is not suitable for some of the hauling on the farm.

Many others stated that they used their horses for all hauling on the farm because there was no advantage in using the truck for such work. Most of the time required for hauling on the farm is taken up with loading and unloading, and the percentage of the total time

which will be saved by the truck when used for such work is small as compared with the time it will save in road hauling. When there are horses on the farm which would otherwise be idle, it would naturally be more profitable to use the horses and let the truck stand idle if there is no advantage in time saved or convenience in using it.

The reasons for using their trucks as given by 145 of the men who reported that they did some hauling on their farms with their trucks are summarized in Table XII. Most of this hauling was crops. (See fig. 3.) In all, 105 men reported that they hauled some crops in the fields with their trucks, and a much smaller number reported the

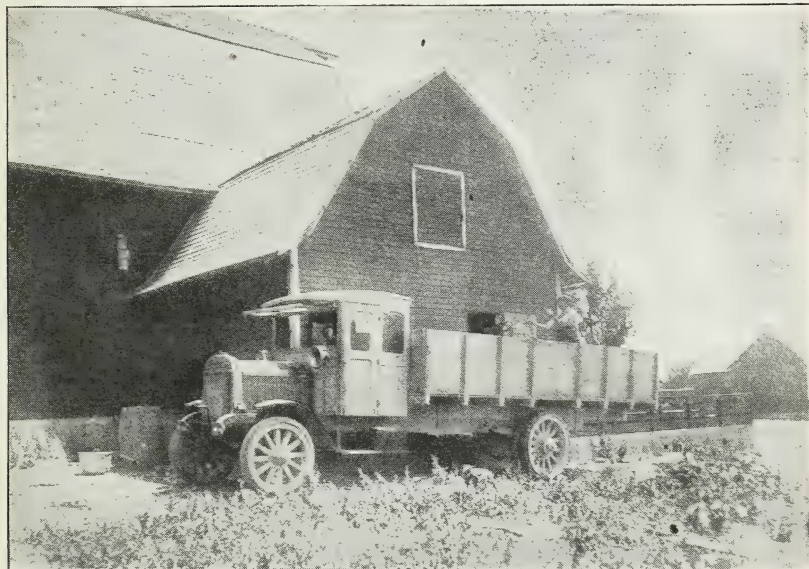


FIG. 3.—Unloading grain from a truck. The motor truck can often be used advantageously for hauling grain from the separator to the granary.

hauling of any other material in the fields and around the buildings. These men who used their trucks for hauling crops on the farm hauled only 48 tons per year on the average. For all farms an average of 83 tons of crops are hauled to market per year. Thus even the men who do use their trucks for hauling on the farm do only a small portion of all the hauling in the fields and around the buildings with them.

TABLE XII.—*Reasons for using truck for hauling on the farm.*

Reasons for using truck.	Number reporting.	Per cent of total.
Time saved.....	82	56
Convenience.....	40	28
Horses busy.....	12	8
Other.....	11	8

Fifty-six per cent of these men gave the saving of time as the reason for using trucks for this hauling. The average length of haul with trucks on the farm was about 235 rods. A truck will save some time over horses on hauls of this length if there is no difficulty in obtaining traction in the fields. It may also save time to use a truck if only one or two loads are to be hauled and the horses and wagons are not ready for use.

Twenty-eight per cent use trucks for some hauling on the farm, because they have found their trucks more convenient than horses. When frequent stops must be made, or when the truck or wagon must be left without attention for a considerable length of time, the truck may be preferable, even though the horses are allowed to remain idle, and the use of the truck does not save any time.

The men whose trucks are equipped with pneumatic tires evidently use them to a somewhat greater extent for hauling on the farm than do the men whose trucks are equipped with solid tires. For instance, 252 owners of 1-ton trucks reported concerning the use of their trucks in hauling on the farm. Forty-eight of them have solid-tired trucks, and only 20 of these 48 used their trucks for any hauling on the farm. One hundred and sixty-nine have trucks with pneumatic tires in front and solids in the rear, and only 71 used their trucks for any hauling on the farm. The remaining 35 have pneumatic-tired trucks and 20 used them for some hauling on the farm. Thus only a little over 40 per cent of the 1-ton trucks equipped with solid tires and of those equipped with pneumatics in front and solids in rear were used for work on the farm, while better than 55 per cent of those equipped with pneumatic tires were used for such work.

CUSTOM HAULING.

Although all of these men use their trucks primarily for hauling to and from their own farms, about 40 per cent of them did some custom work during the year preceding the time of reporting. Of 504 who reported on this item, 295 stated that they had done no custom work. One hundred and eighty-nine of the remaining 209 received on the average \$132 for such work during the year. The number who reported hauling different materials and the price per ton-mile are given in Table XIII. It is seen that most of this hauling was either crops or live stock. On the average the men who hauled crops hauled 35 tons a distance of $9\frac{1}{2}$ miles during the year, and the men who hauled live stock hauled 12 tons a distance of $18\frac{1}{2}$ miles.

About 35 per cent stated that the custom work which they did had not been profitable. It was often stated that the principal reason for doing custom work was to accommodate the neighbors, and in many such cases the price was too low to make the work profitable.

TABLE XIII.—*Price received for custom work.*

Material.	Number of reports.	Price per ton-mile.
Crops.....	103	\$0.38
Live stock.....	119	.46
Building material.....	22	.38
Fuel.....	30	.32
Other.....	46	.53

EFFECT OF DIFFERENT KINDS OF ROADS ON USE OF TRUCKS.

It has been shown that the majority of these farmers considered poor roads the greatest disadvantage in the use of a motor truck, and that most of those who still use horses for part of their road hauling do so because of poor roads. In order to gain a more definite idea of the effect of the kind of roads on the use of motor trucks each farmer was asked to specify the kinds of roads over which his truck traveled and the number of weeks during the past year the roads had been in such condition on account of mud, snow, ice, or frost that the truck could not be used.

All kinds of roads, from unimproved dirt roads to high-class highways, were reported. However, 80 per cent of the men who reported on this point stated that their trucks ordinarily travel only on dirt roads, and 14 per cent stated that the roads which they ordinarily use are part dirt and part improved, and the remainder stated that they have only improved roads, either gravel, macadam, or better.

On the average there were 8.4 weeks during the year when the trucks could not be used, and only about 6 per cent of the men reported that they were able to use their trucks every week. The men whose trucks usually travel on improved roads only, however, were prevented from using them but five weeks during the year, and over one-fourth were able to use them every week.

The reports indicate that poor roads are not such a great handicap to pneumatic-tired trucks as to those equipped with solid tires. Table XIV shows the average number of weeks per year trucks with different kinds of tires on roads which are all or part dirt could not be used.

TABLE XIV.—*Effect of kind of tires on length of time trucks could not be used on roads which are all or part dirt.*

Kind of tires.	Number reporting.	Average number of weeks trucks could not be used.
Pneumatic.....	152	6.6
Solid.....	211	9.4
Pneumatic in front, solid in rear.....	338	9.1

The exact number of weeks these men who have roads which are all or part dirt could not use their trucks is as follows:

Of 152 men who use pneumatic tires—

- 15 were able to use their trucks every week in the year.
- 58 were unable to use them for 1 to 4 weeks in the year.
- 37 were unable to use them for 5 to 8 weeks in the year.
- 25 were unable to use them for 9 to 12 weeks in the year.
- 7 were unable to use them for 13 to 16 weeks in the year.
- 7 were unable to use them for 17 to 20 weeks in the year.
- 3 were unable to use them for 21 weeks or more.

Of 211 men who use solid tires—

- 3 were able to use their trucks every week in the year.
- 56 were unable to use them for 1 to 4 weeks in the year.
- 55 were unable to use them for 5 to 8 weeks in the year.
- 48 were unable to use them for 9 to 12 weeks in the year.
- 28 were unable to use them for 13 to 16 weeks in the year.
- 8 were unable to use them for 17 to 20 weeks in the year.
- 13 were unable to use them for 21 weeks or more.

Of 338 men who use pneumatic tires in front and solid tires in the rear—

- 15 were able to use their trucks every week in the year.
- 82 were unable to use them for 1 to 4 weeks in the year.
- 96 were unable to use them for 5 to 8 weeks in the year.
- 77 were unable to use them for 9 to 12 weeks in the year.
- 27 were unable to use them for 13 to 16 weeks in the year.
- 28 were unable to use them for 17 to 20 weeks in the year.
- 13 were unable to use them for 21 weeks or more.

Ten per cent of these men who have pneumatic-tired trucks were able to use them every week in the year, and less than 30 per cent were laid up for more than eight weeks by poor roads. Less than 2 per cent of the men whose trucks were equipped with solid tires were able to use them every week, and over 45 per cent of them were laid up for more than eight weeks.

Forty-five men who have all improved roads reported the kind of tires with which their trucks are equipped. Two of them are equipped with pneumatic tires, 3 with solid tires, and 40 with pneumatics in front and solids in rear.

The number of weeks during the year these 45 trucks could not be used is as follows:

- 12 could be used every week.
- 16 could not be used for 1 to 4 weeks.
- 6 could not be used for 5 to 8 weeks.
- 7 could not be used for 9 to 12 weeks.
- 4 could not be used for 13 or more weeks.

It does not necessarily follow that horses were always used for hauling when the roads were in such a condition that the trucks could not be used, as on at least a part of these farms there was no hauling which it was necessary to do at such times.

CHANGE OF MARKET.

Each of these men was asked for the name of the town where he usually marketed his produce before the purchase of his truck and its distance from the farm. He was also asked to give the name of the town where the produce hauled by truck is usually marketed and its distance from the farm. The answers of 814 men to these questions show that 215, a little over one-fourth of the entire number, have changed markets since purchasing trucks. For these 215 farmers the average distance to the old market was 6.9 miles, and the average distance to the new market is 17.6 miles. Practically all of these men stated that they have changed markets because the new market is better than the old one. It should be remembered that a considerable number of those who have not changed markets were using first-class markets before they purchased trucks.

The distances from these farms to the markets which they used before buying their trucks and the distances to the markets which they are now using are as follows:

- Of 60 men who formerly used markets 1 to 4 miles distant—
 - 8 now use markets 1 to 4 miles distant.
 - 21 now use markets 5 to 9 miles distant.
 - 13 now use markets 10 to 14 miles distant.
 - 6 now use markets 15 to 19 miles distant.
 - 3 now use markets 20 to 24 miles distant.
 - 2 now use markets 25 to 29 miles distant.
 - 3 now use markets 30 to 34 miles distant.
 - 2 now use markets 35 to 39 miles distant.
 - 2 now use markets 40 or more miles distant.
- Of 112 men who formerly used markets 5 to 9 miles distant—
 - 24 now use markets 5 to 9 miles distant.
 - 37 now use markets 10 to 14 miles distant.
 - 14 now use markets 15 to 19 miles distant.
 - 5 now use markets 20 to 24 miles distant.
 - 8 now use markets 25 to 29 miles distant.
 - 9 now use markets 30 to 34 miles distant.
 - 5 now use markets 35 to 39 miles distant.
 - 10 now use markets 40 or more miles distant.
- Of 33 men who formerly used markets 10 to 14 miles distant—
 - 1 now uses markets 5 to 9 miles distant.
 - 9 now use markets 10 to 14 miles distant.
 - 12 now use markets 15 to 19 miles distant.
 - 2 now use markets 20 to 24 miles distant.
 - 2 now use markets 25 to 29 miles distant.
 - 2 now use markets 30 to 34 miles distant.
 - 1 now uses markets 35 to 39 miles distant.
 - 4 now use markets 40 or more miles distant.
- Of 8 men who formerly used markets 15 to 19 miles distant—
 - 4 now use markets 15 to 19 miles distant.
 - 4 now use markets 20 to 24 miles distant.
- Of 2 men who formerly used markets 20 or more miles distant—
 - 1 now uses markets 20 to 24 miles distant.
 - 1 now uses markets 25 to 29 miles distant.

The fact that a man has changed his market does not necessarily mean that he hauls all of his produce to the new market or that he purchases all of his supplies from that place. In fact, a considerable number still haul some material either to or from the old market.

Before they purchased trucks 80 per cent of these 215 men used markets which were less than 10 miles from their farms, but now 75 per cent of them are using markets which are 10 miles or more distant. One hundred and two of them now use markets which are 15 miles or more from their farms, yet only 159 of the entire 814 are using markets which are 15 miles or more from their farms. Thus two-thirds of all the men who now use markets which are so far from their farms are men who have changed markets since purchasing trucks.

ANNUAL USE OF TRUCKS.

The number of miles per year which a truck travels has a direct bearing on the cost per mile run or per ton hauled. Depreciation, interest, and repairs are all more or less independent of the number of miles per year which a truck runs, and the greater the number of miles traveled per year the less will be the cost per mile for these items. Table XV gives the average of the estimates of the days per year on which they are used and the number of miles traveled per year for trucks of different sizes. The days per year on which the truck is used does not mean the number of full days' work which the truck does, but simply the number of days during the year on which some use was found for it.

TABLE XV.—*Annual use of trucks of different sizes.*

Size of truck.	Days per year on which truck is used.		Miles traveled per year.	
	Days.	Number of estimates.	Miles.	Number of estimates.
$\frac{1}{2}$ -ton and $\frac{3}{4}$ -ton.....	170	54	3,928	62
1-ton.....	112	447	2,630	385
1 $\frac{1}{2}$ -ton and 1 $\frac{3}{4}$ -ton.....	90	81	2,570	82
2-ton.....	86	45	2,837	41
All.....	112	627	2,777	570

In general the smaller trucks are used on a greater number of days and travel a greater number of miles per year. However, the individual reports show that there is no very close relation between the size of the truck and the miles traveled per year. For the farms under consideration the amount of material to be hauled, the length of haul, and the size of truck are all correlated in such a way that no one factor exerts a predominant influence.

The exact number who estimated that their trucks travel different distances per year is as follows:

- 38, or 7 per cent, estimated the annual mileage at 750 or less.
 150, or 26 per cent, estimated the annual mileage at 751 to 1,750.
 155, or 27 per cent, estimated the annual mileage at 1,751 to 2,750.
 91, or 16 per cent, estimated the annual mileage at 2,751 to 3,750.
 51, or 9 per cent, estimated the annual mileage at 3,751 to 4,750.
 37, or 7 per cent, estimated the annual mileage at 4,751 to 5,750.
 14, or 2 per cent, estimated the annual mileage at 5,751 to 6,750.
 11, or 2 per cent, estimated the annual mileage at 6,751 to 7,750.
 11, or 2 per cent, estimated the annual mileage at 7,751 to 8,750.
 12, or 2 per cent, estimated the annual mileage at 8,751 or more.

LIFE AND DEPRECIATION OF TRUCKS.

The average first cost, life, and depreciation per year and per mile of travel for the trucks of different sizes are shown in Table XVI:

TABLE XVI.—*First cost, life, and depreciation charges for trucks of different sizes.*

[Figures in parentheses indicate the number of reports for respective items.]

	Size of truck.			
	$\frac{1}{2}$ -ton and $\frac{3}{4}$ -ton.	1-ton.	1 $\frac{1}{2}$ -ton and 1 $\frac{3}{4}$ -ton.	2-ton.
First cost	\$1,418 (71)	\$929 (582)	\$1,809 (106)	\$2,052 (56)
Extra equipment	29 (57)	49 (489)	52 (83)	77 (46)
Total cost	1,447	978	1,861	2,129
Present age (years)	1.3 (74)	1.3 (588)	1.4 (109)	1.4 (60)
Remaining life (years)	4.6 (37)	4.9 (337)	6.4 (58)	6.0 (30)
Total life (years)	5.9	6.2	7.8	7.4
Annual depreciation	\$245	\$158	\$239	\$288
Miles traveled per year	3,928 (c2)	2,630 (385)	2,570 (82)	2,837 (41)
Depreciation per mile of travel	\$0.062	\$0.060	\$0.093	\$0.102

The quoted price of the truck often does not include some equipment which it is necessary or desirable to have, and each man was asked to report not only the first cost of his truck but also the cost of any extra equipment he had purchased for it. It was found that about two-thirds of the men had bought some equipment which was not included in the quoted price. This extra equipment varied from minor attachments costing only \$2 or \$3 to bodies and cabs costing as much as \$200 or \$300. As shown in the table, the amount spent for this extra equipment has been added to the reported first cost to obtain the total cost.

Three men reported that they own trailers for use with their motor trucks. However, the cost of these trailers was not included in the total cost of the trucks.

The total life of the trucks was figured by adding the present age—that is, the average number of years which the trucks had been owned—to the average of the estimates of the remaining number of years for which the trucks will give satisfactory service. The re-

maining life of the truck depends not only upon its present condition but also upon the probable work it will do in the future and the owner's idea as to when it will be cheaper to discard it and purchase a new one than to spend more time and money on it for repairs. There is quite a wide variation in the individual estimates on this item, but the average life as obtained in this manner gives the best available basis for figuring depreciation costs. The average life of all trucks as figured by this method is 6.5 years.

The annual depreciation was figured by dividing the first cost by the life in years, and depreciation per mile of travel by dividing the annual depreciation by the average number of miles traveled per year. A comparison of these figures with those for the cost of fuel and oil in Table XVIII and for tires in Table XIX shows that for each size the depreciation charge is greater than the combined costs of fuel, oil, and tires.

REPAIRS.

Each truck owner was asked to report the amount he had spent for repairs since the purchase of his truck. A summary of the replies for trucks of different sizes and ages is given in Table XVII.

TABLE XVII.—Average repair cost of trucks of different sizes and ages.

Present age (months owned).	Size of truck.			
	$\frac{1}{2}$ and $\frac{3}{4}$ -ton.	1-ton.	$1\frac{1}{2}$ and 2-ton.	2-ton.
	Average total expense for repairs.			
12 and less.....	\$9	\$13	\$11	\$14
13 to 24.....	38	26	28	35
25 to 36.....	41	62	32	31

The amounts which the owners of trucks of different sizes had spent are as follows:

One-half ton and three-fourths ton trucks:

- Of 43 men who had used their trucks 12 months or less—
 - 24 had spent nothing for repairs.
 - 15 had spent from \$1 to \$37.
 - 4 had spent from \$38 to \$87.
- Of 18 men who had used their trucks 13 to 24 months—
 - 4 had spent nothing for repairs.
 - 9 had spent from \$1 to \$37.
 - 3 had spent from \$38 to \$87.
 - 0 had spent from \$88 to \$137.
 - 2 had spent \$138 or more.
- Of 4 men who had used their trucks 25 to 36 months—
 - 1 had spent nothing for repairs.
 - 1 had spent from \$1 to \$37.
 - 1 had spent from \$38 to \$87.
 - 1 had spent from \$88 to \$137.

1-ton trucks:

- Of 262 men who had used their trucks 12 months or less—
 - 122 had spent nothing for repairs.
 - 118 had spent from \$1 to \$37.
 - 14 had spent from \$38 to \$87.
 - 4 had spent from \$88 to \$137.
 - 4 had spent \$138 or more.
- Of 261 men who had used their trucks 13 to 24 months—
 - 51 had spent nothing for repairs.
 - 154 had spent from \$1 to \$37.
 - 38 had spent from \$38 to \$87.
 - 9 had spent from \$88 to \$137.
 - 9 had spent \$138 or more.
- Of 36 men who had used their trucks 25 to 36 months—
 - 2 had spent nothing for repairs.
 - 18 had spent from \$1 to \$37.
 - 10 had spent from \$38 to \$87.
 - 2 had spent from \$88 to \$137.
 - 4 had spent \$138 or more.

1½ and 1½-ton trucks:

- Of 36 men who had used their trucks 12 months or less—
 - 23 had spent nothing for repairs.
 - 9 had spent from \$1 to \$37.
 - 3 had spent from \$38 to \$87.
 - 0 had spent from \$88 to \$137.
 - 1 had spent \$138 or more.
- Of 56 men who had used their trucks 13 to 24 months—
 - 19 had spent nothing for repairs.
 - 24 had spent from \$1 to \$37.
 - 8 had spent from \$38 to \$87.
 - 2 had spent from \$88 to \$137.
 - 3 had spent \$138 or more.
- Of 7 men who had used their trucks 25 to 36 months—
 - 1 had spent nothing for repairs.
 - 3 had spent from \$1 to \$37.
 - 2 had spent from \$38 to \$87.
 - 1 had spent from \$88 to \$137.

2-ton trucks:

- Of 24 men who had used their trucks 12 months or less—
 - 10 had spent nothing for repairs.
 - 10 had spent from \$1 to \$37.
 - 4 had spent from \$38 to \$87.
- Of 26 men who had used their trucks 13 to 24 months—
 - 2 had spent nothing for repairs.
 - 14 had spent from \$1 to \$37.
 - 7 had spent from \$38 to \$87.
 - 3 had spent from \$88 to \$137.
- Of 5 men who had used their trucks 25 to 36 months—
 - 2 had spent nothing for repairs.
 - 2 had spent from \$1 to \$37.
 - 0 had spent from \$38 to \$87.
 - 1 had spent from \$88 to \$137.

In all, about 50 per cent of the men who had owned their trucks 12 months or less had spent nothing for repairs, but comparatively few of the men who had owned their trucks for more than a year had been free from expense for repairs. Ordinarily the amount which must be spent for repairs during the latter years of a truck's life will be considerably greater than the cost for the first two or three years. None of these trucks is entirely worn out, and it is not possible from the reports to obtain an accurate figure as to the average annual repair cost for the entire life of a truck. In the absence of accurate figures, allowances of \$75 per year for the $\frac{1}{2}$ -ton and $\frac{3}{4}$ -ton trucks, \$75 for the 1-ton trucks, \$100 for the $1\frac{1}{4}$ -ton and $1\frac{1}{2}$ -ton trucks, and \$150 for the 2-ton trucks have been made as fair charges for the average annual repair costs in figuring the cost of operation in Table XXII. (For the repair costs of some trucks which have been in use three years and longer see Department Bulletin 910, "Experience of Eastern Farmers with Motor Trucks.")

GASOLINE AND OIL.

The average number of miles obtained per gallon of gasoline and per quart of cylinder oil by the men who use trucks of different sizes are shown in Table XVIII. The average price which these men paid for gasoline at the time they made their reports (January to March, 1920) was 26 cents per gallon, and the average price of lubricating oil was 70 cents per gallon. The costs per mile traveled are computed from these figures. No attempt was made to learn the amount and value of the grease used, but in any case its value should be only a fraction of that of the lubricating oil.

TABLE XVIII.—*Gasoline and oil requirements of trucks of different sizes.*

[Gasoline, 26 cents per gallon; lubricating oil, 70 cents per gallon. Figures in parentheses indicate number of reports for respective items.]

Size of truck.	Miles per gallon of gasoline.	Cost per mile.	Miles per quart of oil.	Cost per mile.	Total cost per mile for gasoline and oil.
$\frac{1}{2}$ -ton and $\frac{3}{4}$ -ton.....	11.8 (69)	\$0.022	80 (55)	\$0.002	\$0.024
1-ton.....	10.5 (557)	.025	46 (488)	.004	.029
$1\frac{1}{4}$ -ton and $1\frac{1}{2}$ -ton.....	9.7 (102)	.027	52 (88)	.003	.030
2-ton.....	8.0 (57)	.032	38 (48)	.005	.037

TIRES.

Each man was asked to state what he paid for tires and the mileage obtained. The tire cost per mile as shown in Table XIX was figured by simply dividing the average cost of one tire by the average number of miles which the tire run and multiplying this result

by 4 to get the cost for four tires. According to the estimates of 310 men the pneumatic tires on these trucks run on the average 4,400 miles, and the estimates of 161 men show that the solid tires run 7,700 miles. So few of the $\frac{1}{2}$ and $\frac{3}{4}$ -ton trucks are equipped with solid tires and so few of the owners of $1\frac{1}{4}$ -ton and $1\frac{1}{2}$ -ton trucks reported concerning the cost and mileage of solid tires that no figures for solid tires for these sizes are given.

Since the cost of the tires with which a truck is equipped when purchased is included in the first cost of the truck, an allowance must be made for the number of miles which these tires run in order to determine the net tire cost to the user.

According to the estimates of these men the percentage of the total mileage of the trucks obtained from the tires with which they are equipped when purchased is as follows:

Pneumatic tires on the $\frac{1}{2}$ -ton and $\frac{3}{4}$ -ton trucks run 23 per cent of the total mileage.

Pneumatic tires on the 1-ton trucks run 25 per cent of the total mileage.

Solid tires on the 1-ton trucks run 48 per cent of the total mileage.

Pneumatic tires on the $1\frac{1}{4}$ -ton and $1\frac{1}{2}$ -ton trucks run 29 per cent of the total mileage.

Pneumatic tires on the 2-ton trucks run 22 per cent of the total mileage.

Solid tires on the 2-ton trucks run 36 per cent of the total mileage.

The cost per mile as indicated by the cost of tires and the number of miles which they run has been reduced by these percentages in order to obtain the net cost per mile traveled. No attempt was made to ascertain the cost of inner tubes for pneumatic tires, nor to obtain the cost of tire repairs separately from the entire repair costs of the trucks.

TABLE XIX.—*Tire costs.*

Size of truck.	Kind of tires.	Cost per mile.	Allowance for tires on machine when bought.	Net cost per mile.
$\frac{1}{2}$ -ton and $\frac{3}{4}$ -ton.....	Pneumatic (52 reports)....	\$0.039	\$0.009	\$0.030
1-ton.....	Pneumatic (290 reports)....	.023	.006	.017
1-ton.....	Solid (79 reports).....	.022	.011	.011
$1\frac{1}{4}$ -ton and $1\frac{1}{2}$ -ton.....	Pneumatic (27 reports)....	.030	.009	.021
2-ton.....	Pneumatic (14 reports)....	.043	.009	.034
2-ton.....	Solid (14 reports).....	.038	.014	.024

KINDS OF TIRES RECOMMENDED BY USERS.

These truck owners were asked what kind of tires they consider best for their conditions, regardless of the kind they are now using. The kinds of tires which 684 men with trucks of all sizes are now using and the kinds which they have decided are best are as follows:

- Of 161 men who now use pneumatic tires—
 - 159 prefer pneumatics.
 - 2 prefer solids.
- Of 187 men who now use solid tires—
 - 49 prefer pneumatics.
 - 136 prefer solids.
 - 2 prefer pneumatics in front and solids in rear.
- Of 336 men who now use pneumatics in front and solids in rear—
 - 191 prefer pneumatics.
 - 100 prefer solids.
 - 45 prefer pneumatics in front and solids in rear.

In all 24 per cent now use pneumatics, 27 per cent use solids, and 49 per cent use pneumatics in front and solids in the rear. However, experience has caused 58 per cent to decide that pneumatics are best for their conditions, 35 per cent that solids are best, and 7 per cent that pneumatics in front and solids in rear are best.

The kind of tires which a man considers best depends considerably on the size of his truck. The kinds which the owners of machines of different sizes prefer are as follows:

- Of 70 owners of $\frac{1}{2}$ -ton and $\frac{3}{4}$ -ton trucks—
 - 64 prefer pneumatics.
 - 6 prefer solids.
- Of 481 owners of 1-ton trucks—
 - 279 prefer pneumatics.
 - 162 prefer solids.
 - 40 prefer pneumatics in front and solids in rear.
- Of 90 owners of $1\frac{1}{4}$ -ton and $1\frac{1}{2}$ -ton trucks—
 - 44 prefer pneumatics.
 - 42 prefer solids.
 - 4 prefer pneumatics in front and solids in rear.
- Of 43 owners of 2-ton trucks—
 - 12 prefer pneumatics.
 - 28 prefer solids.
 - 3 prefer pneumatics in front and solids in rear.

RELIABILITY.

The reliability of a motor truck, as that of any other machine, has a very decided effect upon its profitableness. If a truck is out of commission for several days at a time when its services are needed and when its owner is depending upon it to help him through a busy time it can scarcely be considered a profitable machine for him to own. Likewise, if a great deal of time is lost on the road on account of motor and tire trouble, breakage, and other mechanical difficulties, this loss and annoyance may overcome all the advantages attending its use.

In order to obtain information as to the reliability of motor trucks for farm use these truck owners were asked to give both the number of days their trucks had been out of commission when needed during the past year and the percentage of the time lost while using them.

Table XX shows the average number of days 784 trucks of different ages were out of commission during the year preceding the time of reporting:

TABLE XX.—*Days trucks of different ages were out of commission when needed.*

Age of trucks (months).	Total number of reports.	Average days out of commission.
12 and less.....	374	0.8
13 to 24.....	354	2.0
25 and over.....	56	2.3
All.....	784	1.4

The total number of days the trucks of different ages were out of commission is as follows:

Of 374 which had been in use 12 months or less—

333 were out of commission no days.

24 were out of commission 1 to 5 days.

13 were out of commission 6 to 10 days.

4 were out of commission over 10 days.

Of 354 which had been in use 13 to 24 months—

281 were out of commission no days.

44 were out of commission 1 to 5 days.

19 were out of commission 6 to 10 days.

10 were out of commission over 10 days.

Of 56 which had been in use 25 months or more—

43 were out of commission no days.

7 were out of commission 1 to 5 days.

1 was out of commission 6 to 10 days.

5 were out of commission over 10 days.

Eighty-four per cent of the trucks had not been out of commission at all when needed, 9 per cent had been out of commission five days or less, and 7 per cent had been out of commission over five days. In general, the newer trucks are somewhat more reliable than the older ones. Practically 90 per cent of those which had been in use 12 months or less had not been out of commission when needed.

The average percentage of time lost on account of motor and tire trouble, breakage, and other mechanical difficulties, by 636 men owning trucks of different ages is given in Table XXI.

TABLE XXI.—*Per cent of time lost by trucks of different ages.*

Age of trucks (months).	Total number of reports.	Average per cent of time lost.
12 and less.....	305	0.5
13 to 24.....	285	1.2
25 and over.....	46	0.6
All.....	636	0.8

The loss reported by men who had used their trucks different lengths of time is as follows:

- Of 305 who had used their trucks 12 months or less—
 - 260 reported the loss of no time.
 - 40 reported the loss of 1 to 5 per cent.
 - 4 reported the loss of 6 to 10 per cent.
 - 1 reported the loss of more than 10 per cent.
- Of 285 who had used their trucks 13 to 24 months—
 - 215 reported the loss of no time.
 - 60 reported the loss of 1 to 5 per cent.
 - 5 reported the loss of 6 to 10 per cent.
 - 5 reported the loss of more than 10 per cent.
- Of 46 who had used their trucks 25 months or more—
 - 31 reported the loss of no time.
 - 15 reported the loss of 1 to 5 per cent.

Eighty per cent of these men stated that they had lost no appreciable time on account of motor and tire trouble and other mechanical difficulties, and only about 1 in 40 reported a loss of more than 5 per cent. As the trucks grow older the amount of time lost and the number of days out of commission will become greater, but farmers in the Eastern States whose trucks have been in use longer than most of these do not often report any serious loss (see Department Bulletin 910, "Experience of Eastern Farmers with Motor Trucks.")

The average length of haul for these corn-belt truck owners is about 9 miles, and the average time required for the round trip is not far from $2\frac{1}{2}$ hours. (See Tables V to VIII.) A loss of 10 per cent of the time on the average trip would mean a delay of only about 15 minutes. Such delays even with the trucks which give the most trouble would scarcely be as serious as the loss due to having a truck out of commission for several days when it is needed.

To a certain extent the reliability of a motor truck, as of any other complicated machine, depends upon the ability of the operator, and the care which the machine is given. About 90 per cent of these trucks are operated by their owners, or some member of the family, and it is to be expected that the owner of such an expensive machine as a motor truck, or any member of his family, would give it a reasonable amount of care, and at least endeavor to operate it intelligently. Furthermore, automobiles are owned on 95 per cent of these farms, and tractors on 50 per cent of them. Thus nearly all the men who drive the trucks have doubtless had considerable experience in the operation of similar machines. The exceptionally small amount of trouble which these trucks have given is doubtless due in part to these facts.

COST OF OPERATION.

The average cost of operating trucks of different sizes is given in Table XXII. The items included are depreciation, repairs, interest on investment, registration and license fees, gasoline and oil, and tire cost.

The figures for annual depreciation are obtained from Table XVI, and those for repairs from page 24.

Interest is figured at 6 per cent on the average investment. The average investment has been found by the rule: Average investment = first cost $\times \frac{\text{years of service} + 1}{\text{years of service} \times 2}$. This is the generally accepted method for determining the average investment in equipment where a fraction of the first cost is charged off each year for depreciation. The interest charge when computed on this basis is slightly greater than when computed on one-half of the first cost.

The registration and the license fees are the averages of those reported for the year of 1920 by the owners. These fees vary considerably in the different States.

The number of miles traveled per year are obtained from Table XV, the gasoline and oil costs from Table XVIII, and the tire cost from Table XIX. The tire costs used are those for pneumatic tires for each size. In no case is the average cost for solid tires more than 1 cent per mile different from the pneumatic tire costs.

No charge has been made for taxes, insurance, housing, or for labor spent in caring for the truck. However, these charges would ordinarily amount to a very small portion of the total cost of operation.

TABLE XXII.—Cost of operating trucks of different sizes.

	Size.			
	$\frac{1}{2}$ -ton and $\frac{3}{4}$ -ton.	1-ton.	$1\frac{1}{2}$ -ton and $1\frac{3}{4}$ -ton.	2-ton.
Fixed charges:				
Annual depreciation.....	\$245	\$158	\$239	\$288
Annual repairs.....	75	75	100	150
Annual interest.....	51	34	63	73
Annual registration and license fee.....	15	12	14	20
Total fixed charges.....	386	279	416	531
Miles traveled per year.....	3,928	2,630	2,570	2,837
Fixed charges per mile.....	\$0.098	\$0.106	\$0.162	\$0.187
Gasoline and oil per mile.....	.024	.029	.030	.037
Tires per mile.....	.030	.017	.021	.034
Total cost per mile.....	.152	.152	.213	.258

COST OF HAULING WITH TRUCKS.

The cost of hauling with a motor truck is determined by the cost of operating the truck, the charge for the driver's time and labor, the size of load hauled, and the percentage of time the truck runs without a load. In Table XXIII are given the cost per mile of haul and the cost per ton-mile of hauling crops with trucks of different sizes. The cost of operating the truck is taken directly from the preceding table. The charge for the driver is obtained by allowing a rate of 50 cents per hour for his time while driving and while loading and unloading the truck. The average time required for hauling different materials as given in Tables V to VIII is 0.12 hour per mile of travel for each size of truck.

It is stated on page 13 that these men have return loads for their trucks about 34 per cent of the time; that is, each truck hauls loads both ways on 34 out of every 100 round trips it makes from and to the farm, and runs without a load 66 one-way trips. The cost of operating the truck and the value of the driver's time for these 66 trips with no load must be charged to the 134 trips with loads, in order to obtain the actual cost per mile of haul. Every 134 miles of haul, then, must bear the expense of 200 miles of travel, or every 67 miles of haul must bear the expense of 100 miles of travel. The cost per mile of haul as given in the table is obtained by multiplying the total cost per mile traveled by 100 and dividing the product by 67.

The cost per ton-mile hauled is determined by dividing the cost per mile hauled by the weight of the load in tons. As shown in Table V the average weight of the load of crops hauled with the $\frac{1}{2}$ -ton and $\frac{3}{4}$ -ton trucks is 1.326 tons; for 1-ton trucks the average load is 1.313 tons; for $1\frac{1}{4}$ -ton trucks and $1\frac{1}{2}$ -ton trucks 1.745 tons; and for 2-ton trucks 2.204 tons. The costs per mile of haul for the trucks of different sizes divided by these figures give the costs per ton-mile.

TABLE XXIII.—*Cost of hauling crops with trucks of different sizes.*

Size of truck.	$\frac{1}{2}$ -ton and $\frac{3}{4}$ -ton.	1-ton.	$1\frac{1}{4}$ -ton and $1\frac{1}{2}$ -ton.	2-ton.
Truck cost per mile run.....	\$0.152	\$0.152	\$0.213	\$0.258
Charge for driver per mile run.....	.060	.060	.060	.060
Total.....	.212	.212	.273	.318
Cost per mile of haul (33 per cent idle running).....	.316	.316	.407	.475
Cost per ton-mile for hauling crops.....	.240	.241	.233	.215

SAVING OF HIRED HELP.

The saving of time is given by these men as the greatest advantage in the use of a motor truck; but the saving of time will not be of any financial benefit to a farmer unless he uses the time thus saved on

other work, or unless it enables him to reduce the expense for hired help.

These men were asked whether or not their trucks reduce the expense for hired help, either man or horse, and if so, to estimate the amount thus saved per year. Of 783 men who answered the question as to whether the truck reduces the expense for hired help 612, or 78 per cent, said that it does, and the remaining 171 that it does not.

Three hundred and eighty-five of the 612 estimated the amount thus saved, and the average of these estimates is \$209. This figure can scarcely be taken to represent the actual amount which the labor bills of these men have been reduced since purchasing their trucks, but rather as their estimates of the amounts by which their bills would be increased if they did not now own trucks, and if they were doing the same amount of work they are now doing.

There is little difference in the percentage of the owners of trucks of different sizes who say that their trucks reduce the expense for hired help or in the amounts which they estimate the trucks save.

If \$209 represents the average saving on the 78 per cent of the farms where the trucks reduce the expense for hired help, the amount saved by the average truck on all farms is \$163 (78 per cent of \$209).

DISPLACEMENT OF HORSES.

The operators of 637 farms reported the number of work stock they owned before the purchase of trucks, and the number they had disposed of since that time. The number of work stock varied from 3 and 4 head on some of the smaller farms to over 20 on the larger ones. In all 6,264 head were kept on the 637 farms before the purchase of trucks. On 276 farms the number had been reduced since the trucks had been purchased by a total of 763. For all farms, this represents a reduction of a little over 12 per cent, and an average displacement of 1.2 head per truck.

Ordinarily the purchase of a truck will not enable a man who owns only 3 or 4 or 5 horses, all of which he sometimes uses as a single unit, to dispose of any. Only 13 of the 87 men who owned less than 6 head reduced their work stock after purchasing trucks.

The number of head owned by different men and the number they disposed of after purchasing trucks are as follows:

Of 87 men who owned less than 6 head before purchasing trucks—
74 disposed of none.
8 disposed of 1.
5 disposed of 2.

- Of 134 men who owned 6 or 7 head before purchasing trucks—
83 disposed of none.
4 disposed of 1.
42 disposed of 2.
5 disposed of 3.
- Of 126 men who owned 8 or 9 head before purchasing trucks—
70 disposed of none.
6 disposed of 1.
33 disposed of 2.
12 disposed of 3.
5 disposed of 4.
- Of 103 men who owned 10 or 11 head before purchasing trucks—
46 disposed of none.
4 disposed of 1.
33 disposed of 2.
13 disposed of 3.
6 disposed of 4.
1 disposed of more than 4.
- Of 76 men who owned 12 or 13 head before purchasing trucks—
35 disposed of none.
3 disposed of 1.
12 disposed of 2.
3 disposed of 3.
16 disposed of 4.
7 disposed of more than 4.
- Of 111 men who owned 14 or more head before purchasing trucks—
53 disposed of none.
1 disposed of 1.
10 disposed of 2.
5 disposed of 3.
26 disposed of 4.
16 disposed of more than 4.
- In all, 57 per cent have disposed of no work stock.
25 per cent have disposed of 1 or 2 head.
14 per cent have disposed of 3 or 4 head.
4 per cent have disposed of 5 or more head.

Evidently the displacement of horses by motor trucks is not as great as the displacement by tractors in the corn belt. Farmers' Bulletin 1093, "Influence of the Tractor on Use of Horses," shows that on 141 corn-belt farms averaging 346 acres in size 2.5 head per farm were disposed of after the purchase of tractors.

FARMS ON WHICH TRACTORS ARE OWNED.

Tractors as well as motor trucks are owned on about half of these farms. However, most of the tractors are on the larger farms. Only 33 per cent of the men with 160 or less crop acres own tractors, while 65 per cent of those with over 320 crop acres own them.

In all, 745 men stated whether they owned tractors and also gave the number of crop acres in their farms. The number of those with

farms of different sizes (*crop* acres, not *total* acres) who do and do not own tractors is as follows:

- Of 32 who operate farms of 80 or less crop acres—
 4 own tractors.
 28 do not own tractors.
- Of 211 who operate farms of 81 to 160 crop acres—
 77 own tractors.
 134 do not own tractors.
- Of 189 who operate farms of 161 to 240 crop acres—
 103 own tractors.
 86 do not own tractors.
- Of 153 who operate farms of 241 to 320 crop acres—
 88 own tractors.
 65 do not own tractors.
- Of 74 who operate farms of 321 to 400 crop acres—
 48 own tractors.
 26 do not own tractors.
- Of 38 who operate farms of 401 to 480 crop acres—
 25 own tractors.
 13 do not own tractors.
- Of 22 who operate farms of 481 to 560 crop acres—
 13 own tractors.
 9 do not own tractors.
- Of 26 who operate farms of 561 acres and over—
 18 own tractors.
 8 do not own tractors.

The ownership of both trucks and tractors has not resulted in any very marked decrease in the number of work stock. Table XXIV shows the number of work stock now owned and the number disposed of since the purchase of trucks on 290 farms of different sizes where tractors are owned. Table XXV shows similar figures for 293 farms where tractors are not owned.

TABLE XXIV.—*Work stock on farms where both trucks and tractors are owned.*

Size of farms (crop acres).	Number of farms.	Present number of work stock per farm.	Reduction since purchase of truck.	Size of farms (crop acres).	Number of farms.	Present number of work stock per farm.	Reduction since purchase of truck.
80 or less.....	3	4.3	1.3	401 to 480.....	16	12.1	2.1
81 to 160.....	65	5.6	1.4	481 to 560.....	11	11.5	1.9
161 to 240.....	81	7.7	1.4	561 and over.....	13	20.5	1.2
241 to 320.....	63	8.8	1.3				
321 to 400.....	38	10.2	1.5	All.....	290	8.7	1.4

TABLE XXV.—*Work stock on farms where trucks, but not tractors, are owned.*

Size of farms (crop acres).	Number of farms.	Present number of work stock per farm.	Reduc- tion since purchase of truck.	Size of farms (crop acres).	Number of farms.	Present number of work stock per farm.	Reduc- tion since purchase of truck.
80 and less.....	19	4.2	0.7	401 to 480.....	8	12.9	2.4
81 to 160.....	110	6.2	0.7	481 to 560.....	9	15.2	1.7
161 to 240.....	66	8.0	1.3	561 and over.....	7	19.1	0.3
241 to 320.....	52	10.2	1.0				
321 to 400.....	22	13.1	1.1	All.....	293	8.5	1.0

Only 5 of the 68 men who have farms of 160 or less crop acres and who own both trucks and tractors are farming with less than four horses. None of the 81 men who have farms of 161 to 240 crop acres is farming with less than four horses, and only 8 are farming with less than six horses. Four of the 63 men with farms of 241 to 320 crop acres, and 1 of the 38 men with farms of 321 to 400 crop acres, are farming with less than six horses.

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